Prenatal Screening for Infectious Diseases and Opportunities for Prevention

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OBJECTIVE: To characterize adherence with recommendations for prenatal infectious disease screening and missed opportunities for prevention of congenital and perinatal infections.

METHODS: Demographic, prenatal, and peripartum information was abstracted from labor and delivery records of a random, stratified sample of live births in 1998 and 1999 to residents of eight active surveillance areas. Adherence with prenatal screening recommendations was evaluated for hepatitis B, syphilis, rubella, human immunodeficiency virus (HIV), and group B streptococcus (GBS). Characteristics of missed opportunities for disease prevention were assessed by univariate and multivariable analysis to account for survey design.

RESULTS: Prenatal screening rates for hepatitis B surface antigen (HBsAg) (96.5%), syphilis (98.2%), and rubella (97.3%) were high. Areas of excess syphilis morbidity did not adhere to recommendations for third-trimester retesting. Testing rates for HIV (57.2%) and GBS (52.0%) were lower and had wide geographic variation. Postpartum rubella vaccination was documented for only 65.7% of rubella-susceptible women. Inadequate prenatal care was the single strongest predictor of missed opportunities for prenatal testing (relative risk 14.6; 95% confidence interval 6.3, 33.7). Blacks were less likely than whites to receive adequate prenatal care and prenatal tests, more likely to test positive for HBsAg and syphilis, and less likely to receive recommended prevention interventions such as postpartum rubella vaccination for susceptible women.

CONCLUSION: Adherence to both long-standing and more recent recommendations for congenital and perinatal disease prevention can be improved, thus perhaps reducing racial disparities in the use of prenatal screening and appropriate prevention interventions. (Obstet Gynecol 2003;102:753–60. © 2003 by The American College of Obstetricians and Gynecologists.)

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Infections transmitted from mother to child, both during pregnancy and during labor and delivery, remain a leading cause of preventable morbidity among newborns. For example, congenital rubella syndrome is vaccine preventable; infection with group B streptococcus (GBS) in the first week of life is preventable by administration of antibiotics during labor to at-risk women[1]; perinatal human immunodeficiency virus (HIV) infection can be prevented by administering antiretroviral therapies and other interventions to infected mothers during the prenatal period, during the intrapartum period, and to the newborn[2,3]; and perinatal hepatitis B can be prevented by administering hepatitis B immunoglobulin and the first dose of hepatitis B vaccine within 12 hours of birth to newborns of infected mothers.[4]

Obstetricians and other prenatal health care providers play a key role in identifying women and infants at risk of infection and delivering available interventions. Prenatal screening is often the critical first step in prevention. Recommendations to screen all pregnant women for evidence of syphilis infection, rubella seronegativity, and hepatitis B surface antigen (HBsAg) have been in place for more than 10 years and form the basis of well-established perinatal disease prevention programs. In the early 1990s, the United States set a goal for elimination of congenital rubella syndrome,[5] and in 1998, an effort to eliminate syphilis was launched. In contrast, recommendations to screen pregnant women for HIV infection or for vaginal or rectal carriage of GBS

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are more recent and have gone through a series of revisions.

The success of perinatal disease prevention programs can be partially assessed by monitoring the incidence of congenital or perinatal infections. To identify weak links in prevention implementation, however, a closer look at prenatal screening practices and compliance with recommendations is necessary. Surveys of providers may shed some light on these issues. Direct evaluations of provider care practices, however, provide a more accurate picture of how prevention recommendations are actually implemented.

We performed a multistate review of labor and delivery records sampled from a population of more than 600,000 live births in 1998 and 1999 to evaluate compliance with recommendations for prenatal infectious disease screening for hepatitis B, syphilis, rubella, HIV, and GBS. We additionally explored compliance with recommendations for maternal postpartum vaccination against rubella and for GBS prevention by intrapartum prophylaxis.

MATERIALS AND METHODS

Our target population consisted of live births in 1998 and 1999 to residents of selected areas of the Active Bacterial Core Surveillance (ABCs)/Emerging Infections Program Network,[6] including counties in the states of Maryland, California, Georgia, Connecticut, Oregon, Minnesota, New York and Tennessee. A stratified random sample of births was drawn from birth registry data on the basis of surveillance area, birth year, and birth hospital (for more details, see Schrag et al[7]). At least 500 births were selected per surveillance area. Within strata, a constant weight was assigned to each sample element on the basis of the inverse probability of selection. Sample weights were further adjusted to account for nonresponse (ie, charts not abstracted). A poststratified adjustment to the weights within each surveillance area and birth year was made so that the weighted number of preterm births equaled the actual number of preterm births in that stratum.[8,9] Thus, when final sample weights were applied, the weighted preterm and term births equaled the actual number of term and preterm births for each surveillance area and year.

Trained abstractors reviewed labor and delivery records of births in our sample by means of a standardized one-page form that included the following information about the current pregnancy: maternal demographics; prenatal care initiation and number of visits; prenatal or peripartal screening for HBsAg, HIV, rubella, syphilis, and GBS; history of intravenous or street drug use; source of labor and delivery payment; receipt of intrapartum antibiotics; and postpartum rubella vaccination. To obtain these data, we reviewed the entire labor and delivery record (eg, nursing and physician notes, medication logs, prenatal records forwarded to the hospital, summary notes). In addition, maternal race and ethnicity, and gestational age at delivery (made on the basis of the date of the last menstrual period) were collected from birth registry files in each surveillance area. Hospital characteristics such as having a GBS prevention policy or standing orders for GBS intrapartum prophylaxis were obtained from an independent survey of hospitals in the ABCs areas.[10]

If maternal race was missing from the labor and delivery record, information from birth registry files was used. Because ethnicity was often missing from medical records, maternal ethnicity from birth registry files was used. Except when otherwise specified, two categories of race, black and nonblack, were evaluated because of the limited representation of Asians and Native Americans in our surveillance areas.

Preterm was defined as delivery at less than 37 weeks' gestation (ie, 259 days). Adequacy of prenatal care was determined by the Kessner Index, which categorizes prenatal care into inadequate, intermediate, and adequate on the basis of timing of initiation of prenatal care, gestational age at delivery, and number of prenatal visits.[11] Because the characteristics of women who received intermediate care were similar to those who received adequate care for the outcomes we evaluated, in univariate and multivariable models, we used two categories: inadequate care versus other. Women with insufficient information in the medical record to calculate a Kessner Index ($n = 51$) were included in the inadequate care category.

Definitions of documented prenatal screening varied by disease depending on the recommended timing for effective prevention interventions. For hepatitis B, syphilis, and rubella, any documented test in the prenatal or labor and delivery period was sufficient for inclusion in the screened category. For GBS and HIV, screening was defined as any documented test 2 days or more before delivery, because laboratory results typically take at least 48 hours to process and effective prophylaxis must be initiated in the intrapartum period. Women who delivered in Fulton county, Georgia; Baltimore, Maryland; and Shelby and Davidson counties, Tennessee, were considered to live in areas of excess syphilis morbidity because they lived in areas that had rates of primary and secondary syphilis infections in 1998 and 1999 of over 20 per 100,000, and were classified as high syphilis morbidity areas by US Centers for Disease Control and Prevention (CDC) for those years.[12]

Table 1. Demographic Characteristics of Delivering Women 1998 to 1999 in Participating Surveillance Areas

Characteristic	Value
Race*	
White	70.4
Black	22.3
Asian	6.1
Other	1.2
Ethnicity*	
Hispanic	10.5
Non-Hispanic	89.5
Age (y), median (range)	29 (13–51)
Age <20 y	8
At least one prenatal visit	98.3
Prenatal record included in labor and delivery chart	95.3
Adequacy of prenatal care	
Inadequate	14.3
Intermediate	31.2
Adequate	53.6
Unknown	0.9
Medicaid payment of labor and delivery	25.1
Documented history of street or intravenous drug use	2.2

Values are expressed as percentage unless otherwise stated; values reported throughout take into account sample weights and design; unweighted $n = 5144$.

* Maternal race was abstracted from the labor and delivery record. When this information was missing, information from birth registry files was used. Maternal ethnicity was obtained from birth registry files.

All analyses were conducted by use of sample weights to account for unequal probability of selection. Data were analyzed by Sudaan 7.5.6 (Sudaan, Research Triangle Park, NC) to account for the stratified survey design. Weighted values are reported throughout. When variables with many categories were analyzed, a *t* test was used to control for multiple comparisons. In multivariable models, all variables that were associated with the outcome with a $P < .15$ in univariate models were considered by PROC MULTILOG. The final multivariable model included main effects that were significant with a $P < .05$. All two-way interactions of main effects were evaluated. Two-tailed *P* values are reported throughout. In multivariable analyses, odds ratios are assumed to approximate relative risks on the basis of the rare disease assumption.

The study protocol was approved by an institutional review board of CDC, and a waiver of informed consent was granted. Appropriate local institutional review boards also reviewed the protocol and either approved it or found it exempt from human subject review.

RESULTS

We reviewed 5144 labor and delivery records representing 629,912 live births in the surveillance areas in 1998 and 1999; 95% (5144 of 5425) of charts selected for inclusion were abstracted.[7] Demographic characteristics of women delivering in these areas are summarized in Table 1. Only a small proportion of women had no documented prenatal care (1.7% overall; range across surveillance areas, 0.4% in Connecticut to 3.1% in Tennessee and in Maryland). The median gestational age at initiation of prenatal care was 9.4 weeks (interquartile range [IQR] 7.6–13.5 weeks' gestation).

Predictors of inadequate prenatal care in univariate analysis included Medicaid payment of labor and delivery, black race, age less than 20 years, and history of street or intravenous drug use (Table 2). These same factors remained significantly associated with inadequate prenatal care in multivariable analysis with Medicaid payment of labor and delivery as the strongest single predictor (Table 2).

A high proportion of women had documented prenatal screening tests for HBsAg, syphilis, and rubella; these proportions varied only slightly by surveillance area (Table 3). Documented HIV testing of pregnant women was less common in the overall population and varied widely by surveillance area (Table 3). Among women

Table 2. Factors Associated With Inadequate Prenatal Care in Univariate and Multivariable Analysis*

Characteristic	Inadequate prenatal care (%) ($n = 805$)	Intermediate and adequate prenatal care (%) ($n = 4338$)	Relative risk (95% confidence interval)	Adjusted relative risk (95% confidence interval)
Medicaid payment of labor and delivery	43.8†	21.7	2.33 (2.01, 2.70)	2.13 (1.73, 2.62)
Black race	36.9	19.7	2.03 (1.74, 2.37)	1.74 (1.41, 2.15)
Age <20 y	14.9	6.7	2.03 (1.66, 2.48)	1.63 (1.22, 2.18)
History of street or intravenous drug use	4.3	1.8	2.02 (1.44, 2.84)	1.64 (1.00, 2.71)

* All four variables that were significant at $P < .15$ in univariate analysis (Medicaid payment of labor and delivery, black race, age <20 years, and history of drug use) remained statistically significant in the multivariable model. These were thus the only four terms included in the multivariable model.

† Values reported take into account sample weights and design.

Table 3. Prenatal Infectious Disease Screening and Test Results Among Women Delivering in 1998 and 1999 by Surveillance Area

Screening test or result	Percentage by surveillance area				
	Overall (n = 5144)*	3 San Francisco area counties, California (n = 575)	Connecticut (n = 761)	20 Atlanta area counties, Georgia (n = 866)	Maryland (n = 665)
Any HBsAg test	96.5†	99.0	95.8	95.3	95.5
HBsAg test at admission only	1.7	0.8	0.3	1.1	3.9
HBsAg positive‡	0.35 (0.19, 0.51)	0.69 (0.02, 1.36)	0.13 (0, 0.38)	0.06 (0, 0.16)	0
Any syphilis test	98.2	99.0	98.5	98.5	98.2
Syphilis test at admission only	2.7	1.0	1.4	3.2	5.5
Syphilis positive	0.70 (0.41, 0.99)	0.6 (0, 1.2)	0.2 (0, 0.5)	1.6 (0.5, 2.7)	1.0 (0.2, 1.8)
Any rubella test	97.3	98.9	97.9	96.7	95.4
Rubella susceptible	7.1 (6.3, 8.0)	7.8 (5.4, 10.2)	8.5 (0, 17.2)	6.2 (4.1, 8.3)	8.9 (6.5, 11.3)
Any HIV test ≥2 d before delivery	57.2	38.5	35.1§	65.7	69.1
HIV test at delivery only	1.1	0.3	2.1	0.5	1.5
Any GBS culture ≥2 d before delivery	52.0	42.4	61.4	54.5	70.3
GBS positive	23.6 (21.7, 25.5)	21.2 (15.9, 26.5)	23.9 (19.6, 28.3)	24.5 (19.6, 29.4)	20.9 (17.0, 24.8)

HBsAg = hepatitis B surface antigen; HIV = human immundodeficiency virus; GBS = group B streptococcus.

* n represents the unweighted sample size.

† Values reported throughout take into account sample weights and design.

‡ The percentage positive among screened women is reported throughout; 95% confidence intervals are provided in parentheses.

§ From October to December 1999, after the enactment of a mandatory newborn testing policy with results in 48 hours for mothers of unknown HIV status, the proportion of women with documented testing increased to 81%.[20]

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who did not undergo HIV testing, documentation that the patient was offered testing and declined was rare (6.3%). In Connecticut, the proportion of women with a documented HIV test performed at admission for delivery or earlier in pregnancy increased significantly after a law requiring mandatory testing of newborns to mothers of unknown HIV status went into effect in October 1999 (Connecticut: October–December, 1999: 80.5%; 95% CI 72.3, 88.7; before October 1999: 30.7; 95% CI 27.0, 34.3). In New York, the proportion of women with a documented HIV test performed at admission for delivery or earlier in pregnancy increased significantly after an expedited testing requirement was incorporated in August 1999 into an existing mandatory newborn testing law: (August–December, 1999: 83.3%; 95% CI 75.0, 91.5; before: 52.2; 95% CI 47.3, 57.1). Approximately half of women underwent documented GBS testing before delivery; the prevalence varied widely across areas (Table 3).

HBsAg, syphilis, and rubella testing typically occurred at the first prenatal visit (median gestational age at prenatal testing, 9.5 weeks; IQR 7.6–13.6 weeks). HIV testing was also often performed at the initiation of prenatal care (median gestational age at HIV testing, 9.9 weeks; IQR 7.7–15.4 weeks). A very low percentage of women received their first HBsAg, syphilis, or HIV test after admission for labor and delivery (Table 3).

Among women who underwent syphilis testing, 18.5% had two documented prenatal tests; two tests were most common in Maryland (42% had two tests) and Connecticut (37% had two tests). Among women receiving a second prenatal syphilis test, tests were performed at a median gestational age of 28.4 weeks (IQR 27.1–31.7). Among women (unweighted n = 725, representing 123,611 births) who delivered in counties with a high syphilis incidence, 16% had at least two documented prenatal syphilis tests (range, 0% in Davidson and Shelby counties, Tennessee, to 45% in Baltimore City, Maryland), and 46% had a documented syphilis test at admission for delivery.

GBS testing was performed late in pregnancy (median gestational age, 35.6 weeks; IQR 34.0–36.3 weeks). Among women with GBS test date information available (unweighted n = 2034; 78% of screened women), 11% had their most recent GBS test before the third trimester of pregnancy.

Because testing for HBsAg, rubella, and syphilis were strongly correlated with each other, we evaluated whether lack of testing for all three infections (unweighted n = 68) was associated with prenatal care, race, ethnicity, maternal age, or Medicaid payment of labor and delivery. Inadequate prenatal care was the only significantly associated predictor. Women with no prenatal care were at highest risk of having none of these

Percentage by surveillance area			
7 Minneapolis area counties, Minnesota (n = 605)	7 Rochester area counties, New York (n = 550)	3 Portland area counties, Oregon (n = 498)	5 Urban counties, Tennessee (n = 623)
97.9	98.0	98.8	95.3
1.2	0.4	0.2	4.0
0.38 (0, 0.91)	0.45 (0, 1.1)	0.94 (0.02, 1.86)	0.95 (0.09, 1.81)
98.8	99.3	98.5	95.5
0.8	1.2	0.4	4.3
0	0.4 (0, 0.9)	0.5 (0, 1.1)	0.4 (0, 0.9)
99.0	98.6	99.1	95.1
7.1 (4.9, 9.3)	4.6 (2.8, 6.4)	10.6 (7.8, 13.4)	7.0 (4.6, 9.4)
61.7‖	58.0	25.3	85.3
0.8	0.6	0.2	2.0
36.3	63.5	24.4	42.6
29.3 (22.4, 36.2)	24.2 (19.5, 28.9)	30.5 (21.9, 39.1)	24.0 (18.2, 29.8)

three tests, compared with women with at least one prenatal visit (relative risk [RR] 11.87; 95% confidence interval [95% CI] 4.27, 32.98). Among women with at least one prenatal visit, however, women with inadequate prenatal care were still more likely to lack testing for these three infections than those with intermediate or adequate care (RR 14.6; 95% CI 6.3, 33.7). When HBsAg testing alone was evaluated, significantly more Asians were tested than non-Asians (99.4% versus 96.4%; $P < .001$).

In univariate analysis, HIV testing was more common among teenagers (70% versus 56%; RR 1.25; 95% CI 1.16, 1.36), women with intermediate or adequate prenatal care (59% versus 49%; RR 1.20; 95% CI 1.10, 1.32), and women who used Medicaid to pay for labor and delivery (65% versus 54%; RR 1.20; 95% CI 1.14, 1.27). When whites were used as the referent group, blacks were significantly more likely to receive HIV testing (68% versus 55%, $P < .001$) and Asians were significantly less likely to receive HIV testing (44% versus 55%, $P = .002$). In multivariable analysis, these main effects remained significantly associated with increased likelihood of HIV testing before delivery, and the strength of the associations remained similar.

Factors associated with GBS screening in this population have been described previously.[7] Hispanics in the sample were less likely to be screened than non-Hispanics. Although HIV testing and GBS testing each occurred in slightly more than 50% of deliveries, HIV and GBS prenatal screening were not strongly associated with each other (RR 1.18; 95% CI 1.12, 1.25). Only 32% of women had both tests.

For each prenatal infectious disease screening test, we evaluated whether positive (or for the case of rubella, susceptible) test results were associated with the following variables: age, race, ethnicity, Medicaid payment of labor and delivery, inadequate prenatal care, and history of intravenous or street drug use.

HBsAg positivity was rare among screened women across our surveillance areas (unweighted $n = 21$; Table 3). When whites were used as a referent group, black (RR 5.73; 95% CI 1.62, 20.23) and Asian women (RR 30.22; 95% CI 9.06, 100.73) had an elevated risk of HBsAg positivity. No teenage mothers were HBsAg positive in this study; the median age of HBsAg-positive women (25.7 years; IQR 22.6–31.2 years) was similar to the median age of HBsAg-negative women (28.7 years; IQR, 23.9–32.72 years).

Positive syphilis test results were similarly rare in the population (unweighted $n = 30$; Table 3). Positive syphilis test results were significantly more common among blacks than nonblacks (RR 2.95; 95% CI 1.24, 7.02). The median age of syphilis-positive women (25.3 years; IQR, 22.9–30.5 years) was similar to the median age among women who tested negative for syphilis (28.7 years; IQR 23.6–32.7 years). There was no significant association between history of street or intravenous drug use and syphilis positivity, although the low prevalence of syphilis positivity and documented drug use in this population limits the detection of an association.

Rubella susceptibility (7.1%; unweighted $n = 349$) was more prevalent in the overall population than HBsAg or syphilis positivity. Rubella susceptibility was less common among blacks than among nonblacks (adjusted RR 0.62; 95% CI 0.42, 0.90) and more common among women who used Medicaid to pay for labor and delivery (adjusted RR 1.54; 95% CI 1.14, 2.08). It was not signif-

icantly associated with Hispanic ethnicity in univariate analysis (RR 0.87; 95% CI 0.61, 1.24).

Among women screened for GBS colonization, black women were marginally more likely to be colonized with GBS than white women (28% versus 23%; $P = .05$). In contrast, Asian women were significantly less likely to be colonized with GBS than white women (11% versus 23%; $P < .001$). Ethnicity was not significantly associated with GBS carriage (Hispanic, 24.2%; non-Hispanic, 23.6%; $P = .88$). Although GBS colonization was more common among women who delivered before term, this association was not statistically significant (28% versus 23%, $P = .27$).

For rubella and GBS, we were able to evaluate delivery of interventions in addition to prenatal screening. Approximately two-thirds (65.7%) of rubella-susceptible women received a postpartum rubella vaccination before discharge, as documented in the labor and delivery record. This varied by surveillance area from 45% (95% CI 29, 62) in Georgia to 84% (95% CI 73, 94) in Oregon. Of the demographic variables available for evaluation, race was the only factor significantly associated with postpartum vaccination, with black susceptible women less likely to receive vaccine than nonblack susceptible women (51.0% versus 68.7%; RR 0.7; 95% CI 0.5, 1.0).

As reported previously,[7] 89% of women with a GBS positive test result before delivery received intrapartum antibiotics. Among GBS-positive women ($n = 630$), maternal race, age, Medicaid payment of labor and delivery, and delivery of a preterm infant were not significantly associated with receipt of intrapartum antibiotics. Hospital admission for at least 8 hours before delivery was significantly associated with receipt of intrapartum antibiotics among GBS-positive women (95% versus 81%; RR 1.17; 95% CI 1.09, 1.26). Although more GBS-positive women who delivered at hospitals with a GBS prevention policy received intrapartum antibiotics (90% versus 84%), the difference was not statistically significant (RR 1.07; 95% CI 0.99, 1.17). Similarly, GBS positive women who delivered at hospitals with standing orders for intrapartum antibiotics were not more likely to receive intrapartum antibiotics than those delivering at hospitals without standing orders (90% versus 87%; RR 1.03; 95% CI 0.96, 1.11).

DISCUSSION

Prenatal screening is a key step in identifying women at risk of vertically transmitting infections to their neonates and often allows for timely initiation of interventions to prevent perinatal infection. This is particularly true for programs that have disease elimination (congenital syphilis and rubella) and maximal reduction (perinatal HIV) goals. Our population-based review of births in 1998 and 1999 suggests that although compliance with prenatal screening recommendations is high for longer-standing guidelines, there is room for improved implementation of prevention recommendations for all the diseases evaluated. Our results also stress the continued importance of reducing racial disparities in receipt of prenatal tests and administration of interventions to prevent perinatal disease transmission.

Prenatal screening rates of more than 90% for syphilis, rubella, and HBsAg can be considered a success. For the case of syphilis, however, adherence with recommendations for patients living in areas of excess syphilis morbidity was not as strong. For this higher risk group, national guidelines recommend a second syphilis test at 28 weeks' gestation to allow time for treatment of infections acquired during pregnancy, and a third test at the time of delivery.[13] Among surveillance counties with high incidence of syphilis in 1998 and 1999, only a small proportion of women had a documented late antenatal test. This was true even in Baltimore, despite an epidemic of congenital syphilis in 1996 to 1997.[14] Review of cases identified by congenital syphilis surveillance has often identified failure to test late in pregnancy as a missed opportunity to prevent neonatal infection.[15]

For the case of rubella, successes in the arena of prenatal screening now allow a focus on improving postpartum vaccination of rubella-susceptible women. Overall, only two-thirds of rubella-susceptible women had a documented postpartum vaccination before discharge, and this was as low as 45% in one surveillance area. Because failure to vaccinate susceptible women after delivery represents a missed opportunity for prevention of congenital rubella syndrome in subsequent pregnancies, these results suggest a need for improved postpartum vaccination implementation. A recent national survey of hospitals found that only 21% of hospitals had policies for postpartum rubella vaccination.[16] As of 1999, only Puerto Rico and Nevada had passed legislation requiring postpartum rubella vaccination.

The high compliance with prenatal screening recommendations for HBsAg suggested by our findings and provider surveys[17,18] suggests that the primary prevention challenge for perinatal hepatitis B infection is reaching women without prenatal care and administering appropriate interventions to HBsAg-positive women and their newborns.[19] CDC estimates that 20,000 infants are born to HBsAg-positive women annually, but only 50% were identified by health departments in 2001. All states and five metropolitan areas receive federal funding to identify HBsAg-positive women and their infants and to conduct case management to facilitate timely and complete immunoprophylaxis, vaccination of

household members and sexual contacts, and postvaccination testing of infants to identify those who were infected during the perinatal period.

Public Health Service guidelines in 1995 recommended that all pregnant women receive counseling about the risks of perinatal HIV and be offered voluntary HIV testing.[3] In 1998 and 1999, all of our surveillance areas had at least a regulation or policy related to counseling of pregnant women and voluntary HIV testing. Nonetheless, less than 60% of delivering women had documented HIV testing before delivery, and this was as low as 25% in one surveillance area. Additionally, among women with no documented HIV test, documentation of counseling or documentation that a test was offered and refused was extremely rare. It is possible, however, that we underestimated HIV testing during pregnancy either because providers failed to document tests for confidentiality reasons, or because patients sought anonymous testing unaffiliated with their prenatal care providers.

The surveillance areas with opt-out laws requiring HIV testing of pregnant women unless they specifically refused (Tennessee) or mandatory newborn testing legislation (Connecticut and New York) had much higher rates of prenatal HIV testing than other areas. Similar trends toward high prenatal HIV testing rates have been seen among Canadian provinces with opt-out policies.[20] Recent approval of a rapid HIV test with results available in 20 minutes, along with growing evidence of the success of opt-out approaches, led CDC to release a strategy for advancing HIV prevention in 2003 that promotes routine HIV testing of all pregnant women and routine screening of any infant whose mother was not screened.[21]

In 1998 and 1999, national guidelines for prevention of GBS disease[22–24] allowed providers to choose between a late antenatal culture-based screening strategy for identifying candidates for intrapartum prophylaxis or an alternative strategy based on providing intrapartum prophylaxis to women with specific risk factors in the intrapartum period. In our surveillance areas, only 52% of deliveries had documented GBS screening. Screening was typically performed at the recommended period late in gestation, and overall, close to 90% of screen-positive women received intrapartum prophylaxis. In 2002, revised guidelines for the prevention of perinatal GBS disease recommending universal prenatal screening of all pregnant women late in gestation were issued.[1,25] Release of these new guidelines heightens the need for adherence to the screening strategy.

For all prenatal screening tests we evaluated, inadequate prenatal care was one of the strongest predictors of lack of prenatal testing. We identified that Medicaid insurance, black race, age less than 20 years, and street drug use were associated with inadequate prenatal care, findings consistent with those of previous studies. Overcoming barriers to prenatal care among women with these characteristics remains a priority. Additionally, where feasible, implementing strategies such as on-site testing and same-day treatment for syphilis may minimize missed opportunities among pregnant women who infrequently access health care. Newly approved rapid tests for HIV[21] and GBS may also help deliver intrapartum interventions to women who did not seek prenatal care.

Reducing racial disparities in receipt of prenatal testing and other prevention interventions also remains a high priority. For HIV testing, our data suggest that providers may be performing HIV tests on patients they perceive as at higher risk for disease (eg, blacks, patients with Medicaid insurance). Such profiling may result in missed opportunities for prevention among women perceived to be at lower risk. However, for most of the tests evaluated, we found that black women were less likely to receive prenatal tests, and for postpartum rubella vaccination, documented rubella-susceptible black women were less likely to receive postpartum vaccinations.

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APPENDIX

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